

CLAIMS

1. An apparatus for ablating tissue, comprising:  
a shaft; and

5 a tissue-ablating electrode comprising a first end portion and a middle portion supported by respective lengthwise sections of the shaft, wherein the total energy-emitting surface area of the electrode per unit length of the shaft is greater for the middle portion of the electrode than for the first end portion of the electrode.

10 2. The apparatus of claim 1, wherein the first end portion of the electrode comprises a first section of a coiled conductor, which first section has spirals that are spaced apart from one another.

15 3. The apparatus of claim 2, wherein the middle portion of the electrode comprises a second section of the coiled conductor, which second section has spirals that are closer together than the spirals of the first section of the coiled conductor.

4. The apparatus of claim 3, wherein at least two of the spirals in the second section of the coiled conductor touch each other.

20 5. The apparatus of any of claims 1-4, wherein the electrode comprises a coiled conductor having spaces between at least some of its spirals, and a cross-sectional width of the conductor forming the spirals is narrower in the first end portion than in the middle portion.

25 6. The apparatus of any of claims 1-5, wherein the electrode comprises at least two separate coiled conductors having interleaved spirals.

30 7. The apparatus of any of claims 1-6, wherein the electrode comprises a coiled conductor having spaces between adjacent spirals that gradually decrease in size beginning at each end of the electrode and ending in a middle of the electrode.

8. The apparatus of claim 1, wherein the electrode comprises a conductor of a generally cylindrical shape that is partially masked with a non-conductive substance at least in the first end portion of the electrode.

5 9. The apparatus of claim 1, wherein the electrode comprises a conductor of a generally cylindrical shape.

10. The apparatus of any of claims 1-9, in combination with an ablation energy generator to energize the electrode with sufficient energy to ablate tissue.

10 11. The apparatus of any of claims 1-10, wherein the shaft comprises a distal end of an elongated catheter.

12. The apparatus of claim 11, wherein the distal end of the elongated  
15 catheter is steerable.

13. The apparatus of any of claims 1-12, wherein the electrode is mounted on the shaft such that at least a portion of an end of the electrode is disposed at least partially below an annular surface of the shaft that is adjacent the end of the electrode.

20 14. The apparatus of claim 13, wherein the electrode is mounted on the shaft such that at an upper surface of the end of the electrode is substantially flush with the annular surface of the shaft that is adjacent the end of the electrode.

25 15. The apparatus of any of claims 1-14, wherein the electrode further comprises a second end portion opposite the first end portion, and wherein the total energy-emitting surface area of the electrode per unit length of the shaft is greater for the middle portion of the electrode than for the second end portion of the electrode.

30 16. A apparatus for ablating tissue, comprising:  
a shaft; and  
a tissue-ablating electrode mounted to the shaft, the electrode comprising at least a first end portion and a middle portion, and having at least one energy emitting area configured in a shape other than a coil, wherein at least the middle portion is configured

and arranged to introduce edge effects in the middle portion such that, when the conductor is energized, the ratio of a first density of ablation energy emitted in a vicinity of the first end portion to a second density of ablation energy emitted in a vicinity of the middle portion is lower than the ratio would be if the electrode were not configured and  
5 arranged to introduce such edge effects in the middle portion.

17. The apparatus of claim 16, wherein the electrode comprises a conductor of a generally cylindrical shape that is partially masked with a non-conductive substance at least in the middle portion so as to introduce edge effects in the middle portion.

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18. The apparatus of claim 16 or 17, wherein the electrode comprises a conductor of a generally cylindrical shape that has a lower density of energy-emitting surface area in the vicinity of the first end portion than in the vicinity of the middle portion.

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19. The apparatus of any of claims 16-18, in combination with an ablation energy generator operatively coupled to the electrode to enable the ablation energy generator to transmit sufficient energy to the electrode to ablate tissue.

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20. The apparatus of any of claims 16-19, wherein the shaft comprises a distal end of an elongated catheter.

21. The apparatus of claim 20, wherein the distal end of the elongated catheter is steerable.

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22. The apparatus of any of claims 16-21, wherein the electrode is mounted on the shaft such that at least a portion of an end of the electrode is disposed at least partially below an annular surface of the shaft that is adjacent the end of the electrode.

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23. The apparatus of claim 22, wherein the electrode is mounted on the shaft such that at an upper surface of the end of the electrode is substantially flush with the annular surface of the shaft that is adjacent the end of the electrode.

24. The apparatus of any of claims 16-23, wherein the electrode further comprises a second end portion opposite the first end portion, and wherein at least the middle portion is configured and arranged to introduce edge effects in the middle portion such that, when the conductor is energized, the ratio of a third density of ablation energy emitted in a vicinity of the second end portion to the second density of ablation energy emitted in the vicinity of the middle portion is lower than the ratio would be if the electrode were not configured and arranged to introduce such edge effects in the middle portion.

25. A apparatus for ablating tissue, comprising:  
a shaft; and  
a tissue-ablating electrode mounted on the shaft, the electrode comprising at least two separate coiled conductors having interleaved spirals.

26. The apparatus of claim 25, wherein the electrode comprises at least three separate coiled conductors having interleaved spirals.

27. The apparatus of claim 25 or 26, in combination with an ablation energy generator operatively coupled to the at least two conductors to enable the ablation energy generator to transmit sufficient energy to the at least two conductors to ablate tissue.

28. The combination of claim 27, in further combination with a controller to control transmission of ablation energy from the ablation energy generator to the at least two conductors in a pulsed, sequential fashion.

29. The apparatus of any of claims 25-28, wherein the shaft comprises a distal end of an elongated catheter.

30. The apparatus of claim 29, wherein the distal end of the elongated catheter is steerable.

31. The apparatus of any of claims 25-30, wherein the electrode is mounted on the shaft such that at least a portion of an end of the electrode is disposed at least partially below an annular surface of the shaft that is adjacent the end of the electrode.

32. The apparatus of claim 31, wherein the electrode is mounted on the shaft such that at an upper surface of the end of the electrode is substantially flush with the annular surface of the shaft that is adjacent the end of the electrode.

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33. An apparatus for ablating tissue, comprising:

a shaft; and

a tissue-ablating electrode comprising a coiled conductor having spaces between at least some of its adjacent spirals, the electrode being mounted on the shaft such that at least a portion of an end of the electrode is disposed at least partially below an annular surface of the shaft that is adjacent the end of the electrode.

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34. The apparatus of claim 33, wherein the electrode is mounted on the shaft such that at an upper surface of the end of the electrode is substantially flush with the annular surface of the shaft that is adjacent the end of the electrode.

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35. A apparatus for ablating tissue, comprising:

a shaft; and

a tissue-ablating electrode mounted to the shaft, the electrode comprising an end portion and a middle portion, and having at least one energy-emitting area configured in a shape other than a coil, the electrode further comprising means for introducing edge effects in at least the middle portion.

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